CLAIMS

1. An imaging apparatus for the three dimensional imaging and/or measurement of a surface including:

first beam modifying means for modifying an incident beam of short coherence length light to form a modified beam of first and second components having a mutual path difference and being capable of producing a detectable interference;

beamsplitting means for splitting said modified beam into first and second beams;

second beam modifying means for modifying the properties of at least one of said first and second beams;

recombining means for thereafter recombining said first and second beams;

means for directing said recombined first and second beams towards said surface and scanning them across the surface; and

means for monitoring the first and second beams after reflection and detecting interference of the reflected first and second beams.

2. An imaging apparatus according to claim 1 further including steering means to vary a nodal point of the scanned first and second beams.

3. An imaging apparatus according to claim 1 or 2, wherein said first beam after said modification of the properties of at least one of said first and second beams is focused on a position in front of said surface for reflection at said position.

4. An imaging apparatus according to claim 3 wherein said second beam is a collimated beam at said scanning means, for being focussed onto said surface.

5. An imaging apparatus according to any preceding claim wherein said scanning means is arranged for scanning in at least two dimensions.

6. An imaging apparatus according to any preceding claim, further including one or more sources of said incident beam of short coherence length light.

7. An imaging apparatus according to any preceding claim wherein said first beam modifying means includes means to modulate the phase difference between said first and second components.

8. An imaging apparatus according to any preceding claim wherein said first beam modifying means includes means to polarize said first and second components.

9. An imaging apparatus according to any preceding claim wherein said first beam modifying means includes interferometric means having at least one optical arm with adjustable mirror means.

10. An imaging apparatus according to any preceding claim, further including beamsplitting means for deflecting said reflected first and second beams to said monitoring and detecting means, when said reflected beams are returned along the optical path of the incident recombined first and second beams.

11. An imaging apparatus according to any preceding claim wherein said second beam modifying means includes beam focusing means.

12. An imaging apparatus according to any preceding claim, including means for varying the direction of incidence of said recombined beam towards

said surface, whereby to obtain at said monitoring and detecting means alternate left and right images of substantially overlapping areas.

13. An imaging apparatus according to any preceding claim, for imaging and/or measuring a surface comprising an ocular fundus.

14. An imaging apparatus according to claim 13 wherein said incident beam is a laser beam, and the apparatus functions in use as a scanning laser ophthalmoscope.

15. An imaging apparatus according to claim 13 or 14 wherein said first and second beams are respectively a focussed beam arranged to be at least partially reflected from the cornea of an eye and a collimated beam for being focussed by the eye onto its fundus for reflection thereby.

16. An imaging apparatus according to any preceding claim, further including image analysing means to obtain three-dimensional topological data of said surface.

17. A method for the three dimensional imaging and/or measurement of a surface including:

modifying an incident beam of short coherence length light to form a modified beam of first and second components having a mutual path difference and being capable of producing a detectable interference;

splitting said modified beam into first and second beams;

modifying the properties of at least one of said first and second beams and thereafter recombining said first and second beams;

directing said recombined first and second beams towards said surface and scanning them across the surface; and

monitoring the first and second beams after reflection and detecting interference of the reflected first and second beams.

18. A method according to claim 17 further including varying a nodal

point of the scanned first and second beams.

19. A method according to claim 17 or 18, wherein said first beam after said modification of the properties of at least one of said first and second beams is focussed on a position in front of said surface for reflection at said position.

20. A method according to claim 19 wherein said scanned second beam is a collimated beam for being focussed onto said surface.

21. A method according to any one of claims 17 to 20 wherein said scanning is in at least two dimensions.

22. A method according to any one of claims 17 to 21 wherein said modifying of said incident beam includes modulating the phase difference between said first and second components.

23. A method according to any one of claims 17 to 22 wherein said modifying of said incident beam includes polarizing said first and second components.

24. A method according to any one of claims 17 to 23 further including deflecting said reflected first and second beams for said monitoring and detecting, when said reflected beams are returned along the optical path of the incident recombined first and second beams.

25. A method according to any one of claims 17 to 24, including varying the direction of incidence of said recombined beam towards said surface, whereby to obtain for said monitoring and detecting alternate left and right images of substantially overlapping areas.

26. A method according to any one of claims 17 to 25, wherein said surface is an ocular fundus.

27. A method according to claim 26 wherein said incident beam is a laser beam and said method includes scanning laser ophthalmoscopy.

28. A method according to claim 26 or 27, wherein said first and second beams are respectively a focussed beam arranged to be at least partially reflected from the cornea of an eye, and a collimated beam for being focussed by the eye onto its fundus for reflection thereby.

29. A method according to any one of claims 17 to 28 , further including obtaining three-dimensional topological data of said surface.

30. A method for scanning a surface with light beams of short coherence length to thereby produce an image and three dimensional topological data of said surface, including:

directing light beams of short coherence length along an input path including:

polarising said beam;

dividing said beam into two sub-components with a defined path difference;

modulating at least one of said sub components;

splitting said sub-components;

focussing said sub-components;

re-combining said sub-components;

scanning said sub-components in a first direction;

scanning said sub-components in a second direction different from said first direction;

directing said sub-components through a beam steerer to provide a triangulation base by impinging said sub-components onto said surface from two different positions;

reflecting said sub-components onto said surface;

whereby reflected light from said surface traverses an output path identical at least in part to said input path, including splitting said sub-components

and directing a portion of the split sub-components through an aperture means towards detecting means coupled to signal processing means and display means, whereby the resultant image can be viewed and three dimensional topological data of said surface can be obtained.

31. An imaging apparatus for the three dimensional imaging and measurement of a surface including:

a beam source for providing a beam of short coherence length light;

a first beamsplitter for splitting said beam into first and second components of short coherence length light;

means for producing a path difference between said first and second components;

a second beamsplitter for splitting said beam into first and second beams;

beam modifying means for modifying the properties of at least one of said first and second beams;

recombining means for recombining said first and second beams;

focussing means for focussing said recombined first and second beams;

first and second beam scanners for scanning said recombined first and second beams in first and second directions;

beam steering means for creating a triangulation base by directing said recombined first and second beams onto said surface from a first and a second position and reflecting said recombined first and second beams therefrom;

a third beamsplitter for splitting said reflected first and second beams;

a detector for detecting the interference of said reflected first and second beams.

32. An apparatus for visualising the ocular fundus of an eye and providing three dimensional topological data of said fundus including:

a light source for producing a beam of short coherence length;

an interferometer for dividing said beam into sub-components with a defined path difference;

modulation means for modulating at least one of the said sub-components;

beam shaping means for shaping said beam and/or said sub-components;

polarisation influencing means for controlling and changing the polarisation state of said beam and/or said sub-components;

a first beamsplitter and recombining means for splitting and re-combing said sub-components;

first focussing means for focussing said sub-components;

a second beamsplitter for splitting the sub-components;

second focussing means for further focussing at least one sub-component;

first scanning means for scanning the sub-components in a first direction;

second scanning means for rescanning the sub-components in a second direction substantially perpendicular to said first direction and thereby converted into a raster pattern;

a beam steerer for creating a triangulation base and directing said sub-components onto said fundus and the cornea of said eye respectively;

light detecting means for detecting said interference pattern after re-combining reflected light from said fundus and said cornea;

signal processing means for processing signals from said light detecting means; and

display means for receiving said processed signals and displaying an image of said fundus.